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ABSTRACT

Measured were the effects of a diet climinating natural salicylates, preservatives, artificial coloring and artificial flavoring on the hyperactive behavior of a 4-year-old boy. Two of four behavioral measures showed a statistically significant reduction in hyperactivity when the diet was introduced. However, when the diet was terminated, the S continued to exhibit a reduction in hyperactivity in all four behavioral measures. In addition, the reduction in hyperactivity was not clinically noticeable in other aspects of the S's daily routine. It was concluded that the additive-free diet was not instrumental in reducing the S's hyperactive behavior. (Author/CL)

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TECHNICAL REPORT NO. 77-02

FAILURE OF AN ADDITIVE-FREE DIET TO CONTROL HYPERACTIVITY: A CASE STUDY

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ABSTRACT

A diet that eliminates foods containing natural salicylates, preservatives, artificial coloring, and artificial flavoring was introduced to a four year old child to reduce his hyperactivity. Four behavioral measures were selected to measure the effects of the diet on the subject's behavior. They were (1 and 2) counting the number of lines on a floor that the subject crossed in one minute (with and without a toy present) and (3 and 4) the amount of time the subject remained seated in a chair (with and without a toy present.) Two of the measures showed a statistically significant reduction in hyperactivity when the diet was introduced. However, when the diet was terminated, the subject continued to exhibit a reduction in hyperactivity in all four of the behavioral measures. Moreover, the reduction in hyperactivity was not clinically noticeable in other aspects of the subject's daily routine. For these reasons, it was concluded that the additive-free diet was not instrumental in reducing the subject's hyperactive behavior.

INTRODUCTION

Hyperactivity in the retarded and emotionally disturbed children is a frequently noticed but poorly understood syndrome. Excessive motor activity, restlessness, short attention span, and unresponsiveness to social sanctions characterize the hyperactive child. Other associated signs might include perceptual inadequacies, motor coordination deficits, and learning difficulties. The disruptive effects of hyperactivity frequently prevent the hyperactive child from being accepted into academic or vocational programs. The institutional child with hyperactivity is not usually manageable in group learning situations, and since staff time for one-to-one interventions is limited, the individual typically receives inadequate, if any, habilitative services.

There is a substantial body of research that addresses itself to the problem of hyperactivity. Investigators who have pursued this problem are confronted with selecting a suitable measure as their dependent variable.[1] Lambert, Windmiller, Sandoval, and Moore (1976) suggest that the clinician look at the behavioral correlates of hyperactivity rather than the genetic or neurological evidence for the syndrome. The observable behaviors that researchers have measured include the duration of non-kinetic activity, time spent in a specific task, and muscular coordination activities such as handwriting and drawing. Reliability of these observations among raters is high, typically falling in the 90% - 100% interval. Other measures of hyperactivity include subjective reports from parents and teachers, and the progress reflected in academic report cards.

[1] A special note of appreciation extended to Thomas Boyd and James Phillips for their part in implementing this study and to Nurhan Findikyan for his indefatigable assistance in preparing this manuscript.

Several modalities of treatment are discussed in the literature. Psychoactive drugs are frequently used treatment for hyperactivity. Commonly used drugs include methylphenidate (Ritalen), Imipramine (Tofranil), Thioridazine (Mellaril), Dextro-amphetamine, Racemic-amphetamine, and more recently, Pemoline (Cylert). Bradbard (1974) reports the effectiveness of both Methylphenidate and Imipramine in treating hyperactivity. Gross (1976) demonstrated the general superiority of Dextro-amphetamine and Methylphenidate over Racemic-amphetamine. In addition, Methylphenidate exceeds thioridiazine as a treatment for hyperactivity (Gittleman-Klein, 1976).

One possible drawback of these medications is the potential risk of state-dependent learning. Such a phenomena occurs when learning, that takes place under a medicated state, is not retained after the drug is allowed to wear off. Swanson and Kinsbourne (1976) found evidence that hyperactive children who received Methylphenidate experienced state-dependent learning, while control subjects did not.

A second treatment modality in hyperactivity has centered around behavioral techniques relying on contingent reinforcement to produce the desired change in behavior. Christensen (1974) utilized a token system and contingent praise as reinforcement. To increase non-hyperactive behaviors, Shofield, Hedlund, and Worland (1974) employed physical hugs and money to produce desireable behaviors while ignoring inappropriate behaviors. Braud, Lupin, and Braud (1975), using bio-feedback to reduce hyperactivity, required their subjects to turn off a tone that signaled muscle tension. Ball and Irwin (1976) attached automated devices to their subjects. These devices detected movement, which delayed an interval reinforcement for non-motor activity. In addition, West and Axelrod (1975) reinforced subjects for imitating prominent (non-hyperactive) classmates in a school setting. Bradford (1974 used behavioral rehearsal to reduce hyperactive behaviors. Finally, Kripper (1975) discusses the new, still unproved,

techniques of megavitamin therapy, sensory-motor training, and the open classroom as possible treatments.

In comparing the relative efficacy of behavioral and chemical treatments of hyperactivity, neither treatment at this time appears to be superior to the other. Bradbard (1974) demonstrated the superiority of drugs over behavioral techniques while Stableford et al (1976) and Christensen (1974) found the reverse. Certainly there is evidence that both modalities of treatment can be effective and that different individuals can benefit from different approaches. Furthermore, their two modalities of treatment may supplement one another. At this time, the term "hyperactivity" should not become a diagnostic entity indicative of a single modality of treatment.

A third technique adduced for the reduction of hyperactivity is the additive-free diet. This diet, developed by Benjamin Feingold (1974), specifically eliminates synthetic colors and flavors, as well as natural salicylates from the foods to be consumed by hyperactive children. With this diet, Feingold (1974, 1975-A) reports a noticeable improvement in behavior, especially in younger children. For example, children, ranging in age from three to five years, may show an improvement within three days of the inception of the diet. For all subjects, Feingold (1976) reports a success rate ranging from 30 to 50 percent. Burros (1975) found that the use of additives in food and the incidence of hyperactivity were correlated, thus supporting Feingold's assertions.

Although Feingold (1974) identifies those additives which should be eliminated, he fails to be objective in specifying the behaviors that will indicate improvement (Feingold 1975-B). For example, Feingold (1975-A) reports improvement in such general and undefined categories of behavior as "hyperactivity", "achievement", impulsiveness", and "aggressiveness".

Feingold presents his aggregate data in an equally ambiguous manner. In four studies (Feingold, 1975-A) 48 percent of the subjects showed a positive "response" to the diet. Here, response is simply defined as "dramatic" or "favorable" improvement in behavior.

Spring and Sandoval (1976) cite Feingold for inadequate and equivical data presented to substantiate the utility of the additive-free diet. A major deficit in Feingold's investigations, according to these authors, is the failure to provide for control groups in many of his studies.

The present investigation was undertaken to objectively quantify the effects of the additive-free diet on a four year old male. It was hypothesized that if the additive-free diet reduced hyperactivity, then the individual should exhibit less motor activity and increased attention span. This change should be evident in operationally defined measures and should also be noticeable in the daily routine of the individual. Finally, hyperactive behavior should increase once the diet is discontinued.

METHOD

The Subject

The subject was a four year old male. His delivery at birth was uncomplicated, following a full term, uneventful pregnancy. At birth, the subject weighed 7 pounds 11 ounces. His two siblings have a normal medical history.

As far as can be determined, for the first 18 months the subject developed normally, reaching his developmental milestones as expected. At the age of one-and-one-half years, the subject contracted pneumonia. Following this, the parents reported that the subject began to vomit frequently and exhibited excessive motor activity. There were convulsive disorders noted. At that time, the subject was placed on a milk-free diet to reduce the vomiting, but this was unsuccessful. A gastro-intestinal examination failed to uncover the source of the problem. Subsequently, he was placed on methylphenidate but this appeared to increase the hyperactivity. Chlorpromazine and Dexedrine were similarly ineffective.

When the subjected was admitted to the institution, he was non-verbal and did not possess any self-help skills. He did not respond to any commands. The subject was uncoordinated, as evidenced by his unsteady gait and clumsiness in holding utensils. On the ward he would continually run in and out of the room, climb onto chairs and tables, and put objects into his mouth. When walking with a staff member, the subject would try to run away or he would simply go limp and drop himself to the floor. He seldom made eye contact with anyone. The subject did not seek companionship with adults or with other children.

The Diet

The additive-free diet was implemented to reduce the subject's hyperactivity. Details as to the diet's content may be found in the book, Why Your Child is Hyperactive, (Feingold 1974). Briefly, the diet consisted of the elimination of natural salicylates (found in some fruits), preservatives,

artificial coloring and artificial flavoring. Under these guidelines, most canned and processed foods were excluded. In their place, the subject received fresh meats and vegetables.

The diet began following the collection of baseline rates of pre-specified behaviors. Although the facility staff was aware of the planned diet, they were not to know exactly when the diet began or when it was discontinued. This precaution was taken to reduce the possibility of bias by the staff. In addition, the staff was instructed to treat the subject as they usually did.

Behavioral Measures

In order to determine the effectiveness of the diet, pre-diet and post-diet behavioral samples were taken. The following measures of hyperactivity were developed:

A. Open Field - A room floor was divided by strips of tape into sixteen squares. The subject was released in one corner of the room and the number of squares that he crossed in one minute was recorded.

B. Open Field with a Toy - Similar to (A), but a toy was put in the room with which the subject could play.

C. Sitting - The patient was placed in a chair and released. The time, in seconds, that he spent in the chair were recorded.

D. Sitting with a Toy - Similar to (C), but a toy was placed in the patient's hands before he was released.

Forty-five measures were obtained on each of the four behaviors before starting the diet. Throughout the duration of this program, the subject continued his daily routine of attending various habilitative programs. In these programs he was reinforced for such responses as obeying simple commands, sitting still, playing with toys, and engaging in pro-social responses (e.g., playing with others.)

The additive-free diet lasted thirty-three days. During this time, an additional forty-five observations on each of the four behavioral measures

were collected. Nineteen days after the diet was terminated, an additional nine measures of the subject's behavior were obtained.

RESULTS

The behavioral observations from before, during, and after the diet were averaged for each condition. The results are presented in Table I.

* * * * Insert Table I * * * *

Three of the behavioral measures showed a reduction in hyperactivity when the subject was placed on the additive-free diet. These conditions were: (B) Open Field with a toy present; (C) Sitting; and (D) Sitting with a toy present. The differences in the means for two of the conditions (B and D) were statistically significant.

After the diet was discontinued, three of the behavioral measures showed a reduction in hyperactivity. There were: (A) Open Field; (C) Sitting; and (D) Sitting with a toy. None of the post-diet means were statistically different from the diet means.

A final comparison was made between the pre-diet and the post-diet means. For each condition there was a difference in scores that represented a reduction in hyperactivity. However, only one of these differences was statistically significant, and that was Condition D (Sitting with a toy present.)

DISCUSSION

There appears to be a general trend of reduction of hyperactivity. Looking first at the open field condition, the data in cordition B (toy present) is compatible with results from other additive-free diet studies. The subject crossed more lines when the diet was removed. On the other hand, when the toy was absent (condition A), the resident's behavioral level remained relatively constant. Data from this condition does not support Feingold's hypothesis.

If we look at the aggregate data from both of these conditions (A and B), there appears to be a (non-significant) decrease in the number of lines crossed from the pre-to-during diet conditions and again from the during-to-post diet condition. This trend (although non-significant) appears to be independent of the diet conditions.

For the data in the two sitting conditions, this trend is even more prominent. Both of the sitting conditions demonstrate an increase in time spent sitting in the chair (this was significant when the toy was present) and continue to show an increase in sitting times when the diet was discontinued.

The data suggests that as the study progressed, the subject became less hyperactive. He sat still for longer periods of time and he crossed fewer lines in an open field. This decrease in hyperactivity did not coincide with changes in the diet. Rather, there appeared to be an on-going, underlying process in which the hyperactivity was reduced in spite of manipulations in the diet. It is postulated that because the subject was reinforced for sitting still and for other non-hyperactive behaviors in the training program areas that he attended, the changes in his behavior were the result of the learning procedures reinforced in these programs. Subjective reports from the staff members of these treatment programs (who were not aware of changes in the diet) indicate that the subject continued to improve in his behavior in spite of the onset and offset of the diet.

The trend is evident in all four of the behavioral measures. In each condition, after the diet ended the subject sat for longer periods of time and crossed less lines than before the diet was implemented. However, since three of the four comparisons ($\bar{X}_A - \bar{X}_B$) are <u>not</u> statistically significant, further elaborate on the trends in the data would not be justifiable or convincing. Thus, the overall results presented in Table I do not support the effectivensss of the additive-free diet.

On three of the four measures the subject continued to improve long after the diet was discontinued. This trend would suggest that the subject was acquiring the desired behavior (i.e., remaining still for long periods of time) as a result of reinforcement contingencies implemented by the staff.

However, the data are only indicative of a "trend" which would support the learning hypothesis. Most of the comparisons are not statistically significant, let alone clinically salient. Thus, an explanation based on learning theory should be avoided.

In summary, this study did not find the magnitude of change in behavior that the proponents of the additive-free diet claim (Feingold 1975-A). The subject exhibited less motor activity, in general, while on the diet than before. However, this change was statistically significant in only two of our four measures. The subject's daily routine, especially when he was not in treatment programs, did not observably change while he was on the diet. Staff still found the subject difficult to walk down the hallway and continued to confine him to his bedroom for his own protection. After the diet was discontinued, the subject did not revert back to the baseline levels of hyperactivity. Instead, his behavior continued to be less hyperactive.

In general, the subject's behavior continued to improve both when the diet was started and again after it was discontinued. It could be postulated that this continuous reduction in hyperactivity resulted from an on-going learning process where non-hyperactive behavior was reinforced. However, this "improvement" did not reach acceptable levels of statistical significance and it was not clinically salient.

TABLE I - FREQUENCY MEANS

	Before Diet $\bar{X}_B$	During Diet $\bar{X}_D$	After Diet $\bar{X}_A$	$\bar{X}_D - \bar{X}_B$	$\bar{X}_A - \bar{X}_D$	$\bar{X}_A - \bar{X}_B$
A. Open Field (Number of Lines Crossed in One Minute)	13.80	13.93	11.22	0.13	-2.71	-2.58
B. Open Field with Toy (Number of Lines Crossed in One Minute)	13.93	10.18	11.44	-3.75 *	1.26	-2.49
C. Sitting (Seconds)	4.89	6.89	9.61	2.00	2.72	4.72
D. Sitting with Toy (Seconds)	3.81	9.21	12.22	5.40 **	3.01	8.41 **

* p .05

** p .001

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